Limited Visual Dam Safety Inspection Summary Report

HI - 00026

Lalakea Reservoir

Hawaii, Hawaii

Prepared by:

U.S. ARMY CORPS OF ENGINEERS
HONOLULU ENGINEER DISTRICT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

May 2006

Dam ID: HI00026
Name: Lalakea Reservoir

Limited Visual Dam Safety Inspection Conducted on: 7 April 2006

I. Purpose:

Due to disaster occurrences of periodic heavy rains and flooding, which has caused extensive damage to property and loss of lives, the Governor has issued a State of Emergency Proclamation extending from February 20, 2006 to April 9, 2006. In light of the tragic failure of the Kaloko dam on Kauai and the continued forecast of heavy rains, emergency inspections of all regulated dams in all counties are being undertaken.

These inspections are for the purpose of determining if any of the regulated dams and reservoirs in the City and County of Honolulu, Maui County or Hawaii County, are suspect for immediate concern to the downstream area under the prolonged conditions of heavy rain showers.

II. Authority

Inspections were authorized under the Hawaii Dam Safety Act of 1987, Chapter 179D "Dams and Reservoirs" of Hawaii Revised Statues, and Title 13, Subtitle 7, Chapter 190, "Dams and Reservoirs" of the Hawaii Administrative Rules.

These inspections were conducted under joint agreements of the U.S. Army Corps of Engineers (ACE), the U.S. Department of Agriculture Natural Resources Conservation Service (NRCS), and the State of Hawaii. The Memorandum of Agreement with the U.S. Army Corps of Engineers is entered into pursuant to 10 U.S.C. § 3036(d)(2), and the Intergovernmental Cooperation Act (31 U.S.C. §6505), and established via support agreement number DL-06-01.

III. Scope

Visual inspection was performed on parts of the embankment and appurtenant works readily available and visible for inspection by the inspection team at the time of the inspection. Such parts and appurtenant works included the upstream slope, crest, downstream slope, abutments and toes, outlet works, and spillway.

On the date of this limited visual inspection, there may or may not have appeared to be any immediate threat to the safety of the dam, however no assurance can be made regarding the dam's condition after this date. Subsequent adverse weather and other factors may affect the dam's condition.

IV. Limitations of Findings and Recommendations

The inspection is based only on visible features/areas of the dam on the day of inspection. The inspection does not entail detailed stability, hydrologic, hydraulic, or seismic investigations. This inspection is not a formal phase I or phase II dam safety inspection and does not include a review or evaluation from each specialist of an inspection team, such as a geologists, civil, geotechnical, structural, or hydraulics engineer. The owner should verify the findings of this report and take corrective actions. The owner may submit to the State alternative corrective actions that are certified by a licensed professional engineer in the State of Hawaii experienced in the design and construction of dams. This inspection does not relieve the owner/operator from their responsibility to conduct routine inspections, maintenance, repairs, modifications, monitoring, documentation, and/or investigative studies.

V. Inspection Team

Organization	Name
U.S. Army Corps of Engineers	Joseph P. Koester
State of Hawaii, Dept. of Land and Natural Resources	Eric Tanaka
State of Hawaii, Dept. of Agriculture	Ernest Alfonso
National Resources Conservation Service	Drew Stout

VI. Owner's Representatives Present

Dr. Ka'eo Duarte, Kamehameha Schools
Mr. Bob Rosehill, Kamehameha Schools

VII. Summary Report Team

Organization	Name
U.S. Army Corps of Engineers	Derek Chow
	Joseph Koester
State of Hawaii, Dept. of Land and Natural Resources	Denise Manuel
	Edwin Matsuda

VIII. Dam Type

The dam is an earthen embankment.

IX. Dam Classification

The current hazard classification of this dam is: High
Based on available data, this classification is believed to still be applicable.

Hazard Potential Classification based on the following:

Category	Loss of Life	Economic Loss
Low	None Expected	Minimal (undeveloped to occasional structures or agriculture)
Significant	Few (No Urban development and no more than a small number of inhabitable structures)	Appreciable (Notable agriculture, industry or structures)
High	More than a few	Extensive community, industry or agriculture.

Based on inventoried storage and height data, the size classification of the dam is: Small

Size Classification based on the following:

Category	Storage (Acre-Feet)	Height (feet)
Small	< 1000	< 40
Intermediate	> 1000 and < 50,000	> 40 and < 100
Large	> 50,000	> 100

X. Summary of Inspection:

Condition Rating Criteria: The conditional terms in this report are used to generally described the conditions below. Inspections, monitoring, and additional investigations are considered to be incidental to all condition ratings.

Satisfactory	Expected to fulfill intended function.
Fair	Expected to fulfill intended function, but maintenance is recommended.
Poor	May not fulfill intended function; maintenance or repairs are necessary.
Unsatisfactory	Is not expected to fulfill intended function; repair, replacement, or modification is necessary.
Unknown	Not visible, not accessible, not inspected, or unable to determine the condition rating based on the observation taken.

A. General appearance:

The reservoir and dam features were easily recognizable. However, the abutment locations were not as clear due to vegetation. The dam appears to have a small drainage area.

Modifications / Improvements: There were no signs of any recent modifications, however, two 6-inch plastic siphon pipes were resting over the embankment and extended into the reservoir to a low level (below current pool).
Based on staff personnel, this reservoir is not subject to flash flood conditions.
Based on staff personnel, this reservoir has no incident history.

Findings and Corrective Actions:

a. The Owner shall maintain documentations including Construction plans, specifications, improvements, modifications, Operations and Maintenance Manuals and routine inspection logs for this dam facility.
b. An EAP is required for High Hazard Dams. Submit an updated EAP for this facility.
c. An Emergency Action Plan (EAP) is under development and anticipated to be submitted to the state on/before 14 April for Kamehameha School dams.
d. Routine inspection logs were not inspected.
e. Dam owners shall provide for routine inspection of the dam.
f. The dam did not appear to be maintained on a regular basis.
g. Access to site appears to be satisfactory.
h. Access to dam is questionable during severe weather conditions and/or spillway overflows. Operational plans and emergency plans need to reflect this deficiency or access provided.
i. Emergency Alarms / Monitors: There were no alarms or monitors observed on this reservoir.
j. Power / Communication: There were no communication systems observed on this reservoir. There were no utility or power poles visible nearby.

B. Access / Security:

Access to the dam was accomplished via an older haul road for cultivation and harvesting operations by former users. Access requires a 4 wheel drive vehicle. Access to dam is questionable during severe weather conditions. Operational plans need to reflect this deficiency or access improved.

Any security issues: It is unknown whether any control valves are locked. Access to the dam is via several locked gates.

C. Inflow Works:

The inflow works were observed but not carefully examined. According to staff personnel, there is one inlet that could feed the reservoir, but it is sealed. This inlet is a 3 ft by 3 ft concrete ditch.

The intake is permanently shut off or diverted away from the reservoir. In times of heavy rain, overland flow fills the reservoir without inflow control.

Findings and Corrective Actions:

a. The intake works were not tested.
b. The intake works appeared to be in satisfactory condition, no corrective actions are required at this time.

D. Reservoir

The reservoir level during the inspection was 2 ft lower than the last mark on a staff gage located atop the trash rack at the low-level drain outlet.
According to staff personnel, the outlet valve at the downstream end of the drain is permanently kept open and the reservoir is normally empty or low.
No sinkholes or depressions were observed within the reservoir.

Findings and Corrective Actions:

a. The reservoir appeared to be in satisfactory condition, no corrective actions are required at this time.

E. Upstream Slope (Satisfactory)

The upstream slope was about 2H: 1V (Horizontal / Vertical).
There was no slope protection observed on the upstream slope.
Sinkholes were not observed.

Findings and Corrective Actions:

a. The upstream slope appeared to be in satisfactory condition, no corrective actions are required at this time.

F. Crest: (Poor)

The dam crest was approximately 20 feet wide. There was a dirt access road on top of the crest, which did appear to be well utilized. There was high vegetation along and on either edges of the crest, especially the downstream side.
Cracks were not observed, however the crest was not entirely visible.
Sinkholes were not observed, however the crest was not entirely visible.
Vegetation observed on the crest ranged from high grass to ginger plants to large trees, principally ironwood.

Findings and Corrective Actions:

a. The dam crest appeared to be in poor condition and requires corrective action.
b. Foot access along one third of the crest was not possible, due to thick vegetation, mostly ginger plants and high grass.
c. Portions of the crest were not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.
d. Tree(s) were observed along the dam crest. Trees have been identified as the probably cause of piping failures, and can possibly cause severe damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.

G. Downstream Slope: (UnSatisfactory)

The downstream slope was in poor condition and not visible due to heavy vegetation.
The slope was very steep, around a 1-1/2 H to 1V slope.
There was no trail access to the downstream slope, or roadway along the downstream toe.
There was no slope protection observed on the downstream slope.
Erosion was not observed on the downstream slope, however the slope was not entirely visible.
Sinkholes were not observed on the downstream slope, however the slope was not entirely visible.
Vegetation was observed on the downstream slope. The majority of the vegetation was ginger plants and guinea grass, with woody trees ranging from 8" to 5 feet in diameter.
Seepage was not observed on the downstream toe, however the slope was not entirely visible.

Findings and Corrective Actions:

a. The downstream slope was not inspected.
b. The downstream slope appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.
c. Slope protection needs maintenance or repair. Description: remove trees and large plants.

d. The down stream slope was not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.
e. Tree(s) were observed on the downstream slope. Trees have been identified as the probably cause of piping failures, and can possibly cause severe damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.

H. Abutments / Toe: (Poor)

The abutments and toe were not entirely visible or identifiable due to heavy vegetative growth. Erosion along the abutment or toe was not observed. Cracks in either direction were not observed, however not entirely visible. There was heavy vegetation along the abutments and toe locations.

Findings and Corrective Actions:

a. The abutments/toe appeared to be in poor condition and requires corrective action.
b. The abutment/toe area was not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.
c. Tree(s) were observed along the abutment/toe. Trees have been identified as the probably cause of piping failures, and can possibly cause severe damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.

I. Outlet Works: (Satisfactory)

Not inspected in detail, not tested.
Water was flowing through the lowest level possible at the upstream gate works, which had a trash rack and was clear. The outlet works were a 10" ductile iron pipe.
The outlet works was controlled via a gate valve on the downstream side of the dam.
The outlet control was not inspected; heavy vegetation obscured access.

Findings and Corrective Actions:

a. The outlet works were not tested.
b. The outlet works appeared to be in satisfactory condition, no corrective actions are required at this time.
c. The terminus of the outlet was not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.

J. Spillway: (UnSatisfactory)

This spillway consisted of a partly lined (dumped rock) channel cut through the crest of the embankment near the right abutment.
The rough dimensions were 4 ft depth, 12-15 ft width, but the vegetation made this difficult to determine.
The spillway channel then feeds a drainage swale that runs along the base of the downstream toe, toward the left embankment and then heads downstream.

The spillway approach was clear inside the reservoir.
There was an erosion scour, about 3 ft deep, within the spillway inlet, just downstream from the crest.
The downstream vegetation appears to be primarily large plants and woody vegetation.
There was heavy vegetation all along the downstream slope.
Further investigations should be conducted to conclude the capacity of the spillway, if this reservoir is to be maintained.

Findings and Corrective Actions:

a. The Spillway appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.
b. Slope protection needs maintenance or repair. Description: remove vegetation, repair lining rocks and fill scours.
c. The spillway approach was blocked. Clear approach.
d. The aforementioned scour could indicate a headcut within the spillway that threatens the embankment. Corrective / mitigative action is required to prevent this problem from moving upstream.
e. Trees are unacceptable in the spillway channel and approach. Take corrective action to address the woody vegetation problem and repair the damaged area.
f. Unclear if spillway is adequately sized. Spillway should pass the probable maximum flood. Verify spillway capacity and take corrective action as required.

K. Down Stream Channel: (Unknown)

The down stream channel was not investigated / inspected.

XI. Additional Comments:

Corrective actions required to maintain safety of this embankment will be extensive. Abandonment is recommended to preserve safety of downstream inhabitants or visitors. According to the owner representatives present, this reservoir serves no vital economic or flood control purpose. If the reservoir is filled by storms, the spillway will not likely perform safely, resulting in overtopping and likely catastrophic breach of the embankment. Erosive breach would likely be slowed somewhat by heavy vegetation, but this would be fortuitous and unpredictable.

Original field inspection notes were scanned and are attached to this summary report. Included are several photos from the site visit to detail important features of the project, captioned to be self-explanatory.

Dam ID: HI00026
Name: Lalakea Reservoir

Per e-mail dated 5/1/2006 12:57 pm from Joe Koester, USACE

Other studies conducted? Unknown

Reservoir:
What is the actual level? Less than 2 ft pool
Normal Operating Level/Range: Drained; no significant impoundment
Range. i.e., 20 to 30 feet Outlet open; current level 2 ft below staff gage

Intake Works:
What is the type of control and where from?
Diversion gate on concrete ditch; permanently closed off

Crest:
Erosion, cracks and sinkholes –
None of any visible; crest surface obscured by dense vegetation

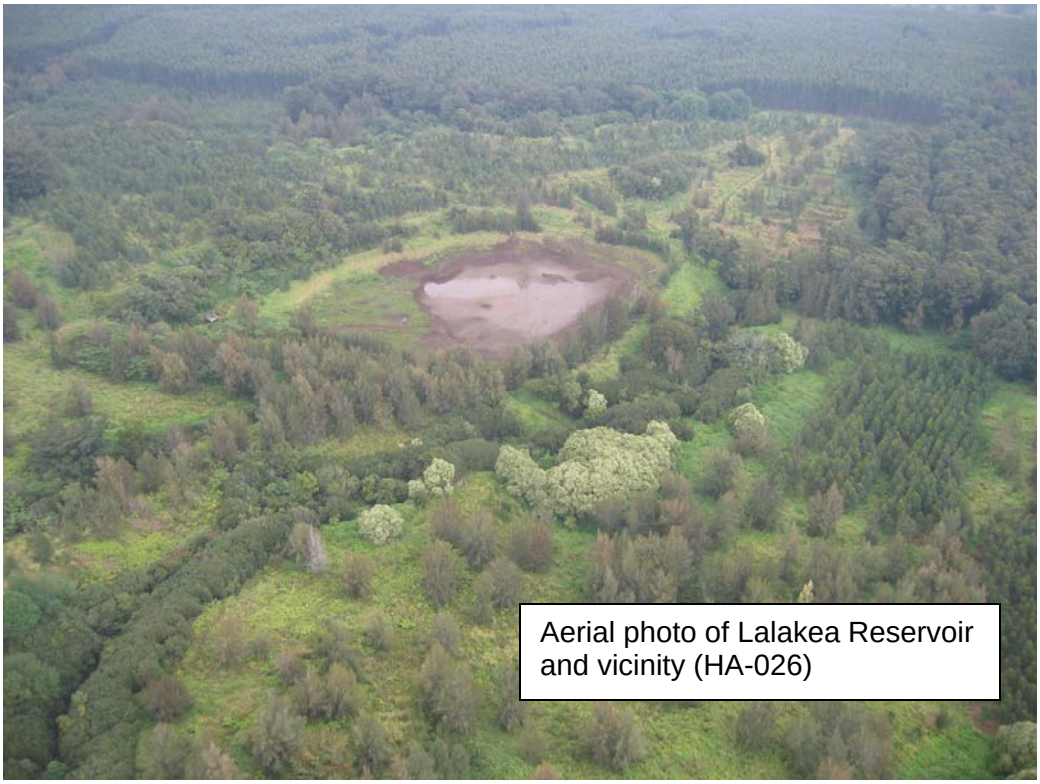
Downstream slope: No intentional slope protection observed. Slope heavily vegetated.

Downstream channel: Undefined drainage way.

Comments:
No immediate threat was posed by the dam at the time of inspection. No action recommended as urgent enough to warrant owner action within 6 months; catastrophic loss of reservoir not likely if water flows in unlined spillway. Eventual headcutting will breach dam, but probably slowly.

PHOTOGRAPHS

Dam ID: HA-026
Name: Lalakea Reservoir

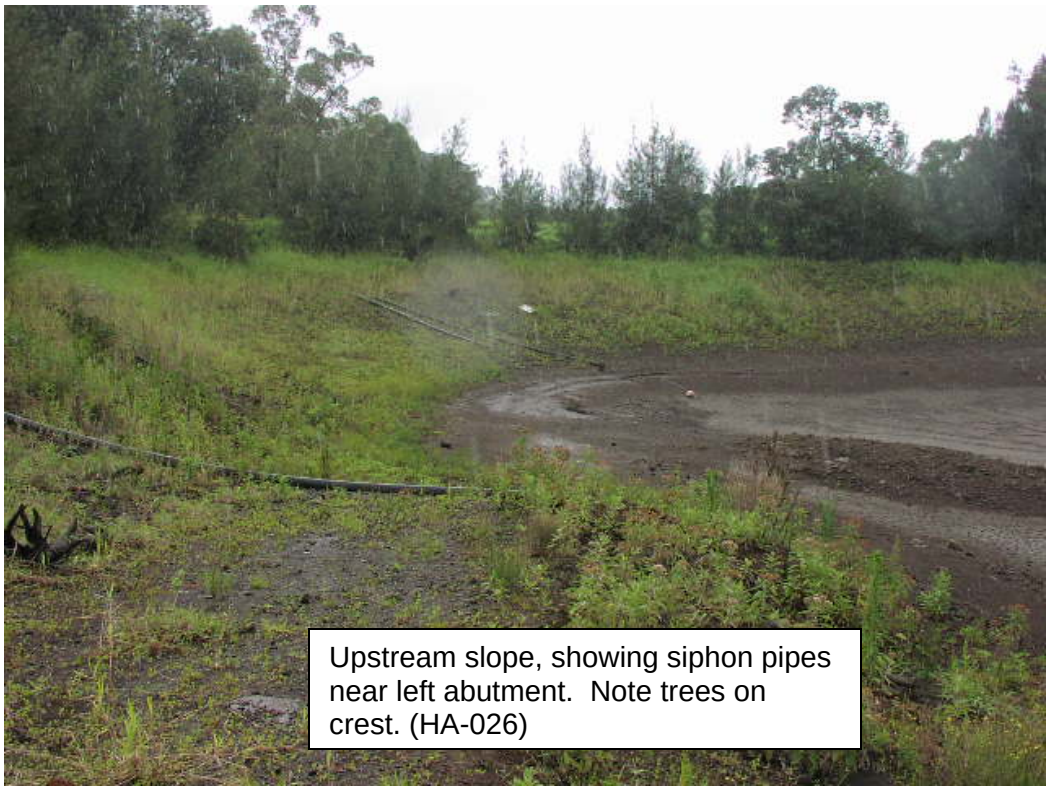


Aerial photo of Lalakea Reservoir and vicinity (HA-026)

View of reservoir as of inspection date. Low level outlet is visible at center right (HA-026)

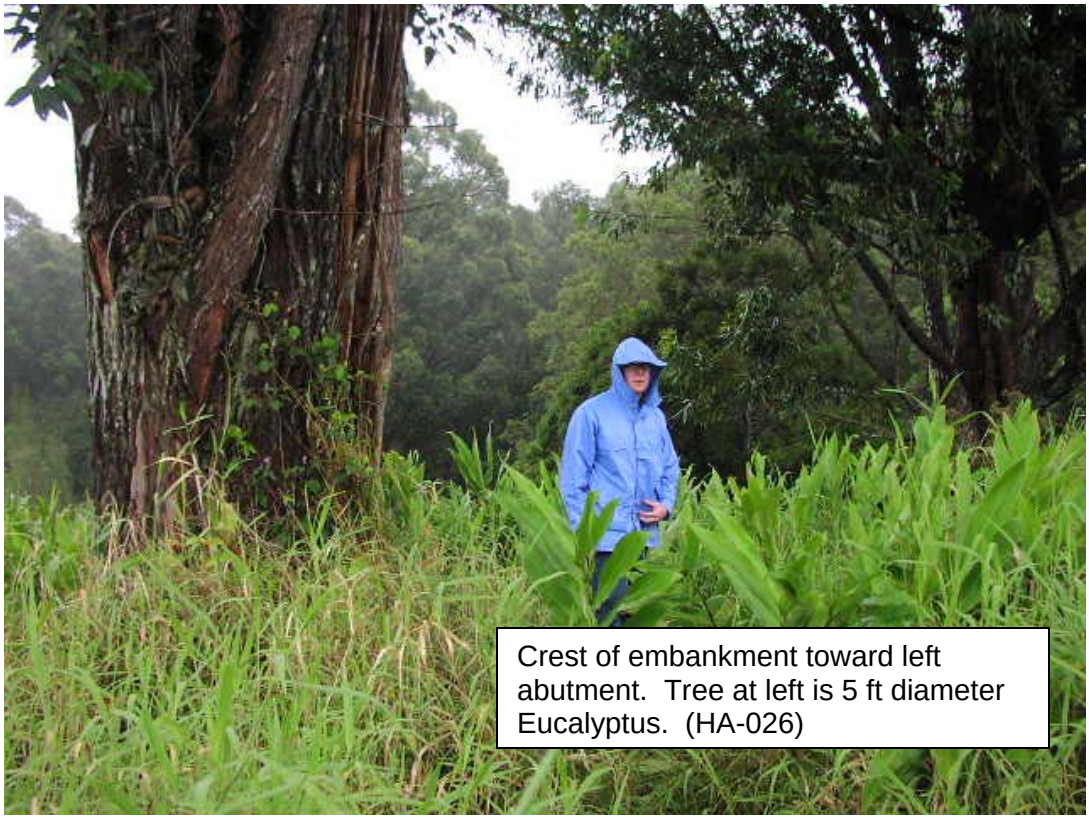
Dam ID: HI00026
Name: Lalakea Reservoir

Upstream end of reservoir. Inlet channel visible in center. (HA-026)



Upstream slope, showing siphon pipes near left abutment. Note trees on crest. (HA-026)

Dam ID: HI00026
Name: Lalakea Reservoir



Crest of embankment toward left abutment. Tree at left is 5 ft diameter Eucalyptus. (HA-026)

Trash rack at low level outlet (HA-026)

Dam ID: HI00026
Name: Lalakea Reservoir

Inlet control structure (diversion gate from paved ditch, 500 ft upstream from reservoir (HA-026)

View of ditch that supplied reservoir prior to closure of inlet gate (HA-026)

FIELD INSPECTION SHEETS

Dam ID: HA-0026
LALAKEA RESERVOIR

Vulnerability Index:
Extreme 1 | High 2 | Moderate 3 | Low 4

Inspection No:
Date: 4-7-06

STATE OF HAWAII - DLNR
DAM SAFETY INSPECTION SHEET

Inspection Type: Visual Dam Safety Inspection

Persons Present	Affiliation	Phone Number
JOE KOESTER	US Army Corps of Engineers	-
DREW STOLT	NRCS	-
ERIC TANAKA	DLNR	-
ERNEST ALFONSO	DOA - HI	-
KA'EO DUARTE	KAMEHAMEHA SCHOOLS	-
BOB ROSEHILL	K S	-

Weather Condition: ☐ Rain previous day ☐ Rainy ☑ Drizzle / Mist ☑ Cloudy/Overcast ☐ Partly Cloudy ☐ Sunny ☐ Dry

Comments:

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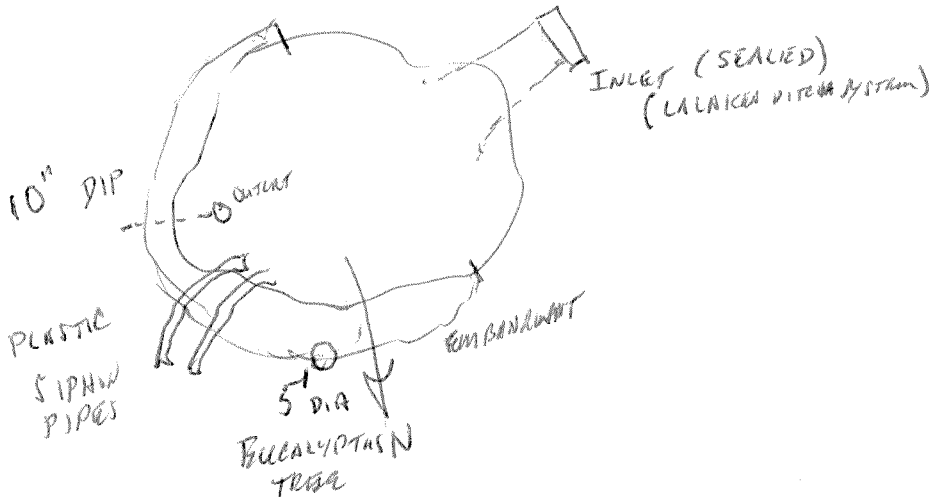
1. General: *(Information currently on file, update as required)*

Dam/Res. Name: LALAKEA RESERVOIR
Owner: Kamehameha Schools *(C002)*
Owner Contact: Mr. Kaeo Duarte — Owner Ph.:
Lessee: — Lessee Ph.:
O & M Contractor: — O & M Ph.:
Nearest Town: KUKUIHAELE — Latitude: 20.09° (decimal)
County: HAWAII — Longitude: 155.5867° (decimal)
Tax Map Key(s): (3)4-8-003:006

Dam Status	A:	Hazard Potential	H:	Dam Size	
Year Completed	1939	Dam Length	800 ft.	Dam Height	26 ft.
Normal Storage	105 ac.ft.	Max. Storage	137 ac.ft.	Max. Surface Area	4.2 ac.
Drainage Area	mi.	Spillway Type		Max. Spillway Q	1100 cfs

Owner owns land under dam facility:
Emergency Action Plan on file with the Department: NO
Reports on file with the Department: Sept. 1997 = Dam Safety Inspection, RM Towill Corp. (3)
Sept. 1978 = Army Corps of Engineers, Initial Dam Safety Inspection / Survey (1)



Dam ID: HA-0026
LALAKEA RESERVOIR

Inspection No: _____
Date: 04-07-06

2. Questions for Owner's Rep.:

	Yes	No	Unknown	Comments
Construction Plans Available	☑	☐	☑	
Site / Facility Map	☑	☐	☑	
Operation & Maintenance Manual	☐	☐	☑	
Emergency Action Plan	☐	☐	☑	UNDER DEVELOPMENT; ANTICIPATED TO STATE 14 APR FOR K.S. DAMS
Modifications / Improvements	☐	☐	☑	
Conduct Routine Inspections	☑	☐	☐	~~LAST~~ INSPECTED ANNUALLY; LAST FORM 2004
Conduct Routine Maintenance	☑	☐	☐	ONLY TO ASSURE DRAINAGE
Vehicle access to site	☑	☐	☐	☐ Not accessible ☐ With Standard car ☑ Requires 4-Wheel Drive
Access during heavy rains	☑	☐	☐	☐ Not accessible ☐ With Standard car ☑ Requires 4-Wheel Drive
Access when spillway is flowing	☑	☐	☐	☐ Not accessible ☐ With Standard car ☑ Requires 4-Wheel Drive
Other Studies Conducted	☐	☐	☐	☐ Phase I ☐ Phase II ☐ Hydraulics ☐ Stability ☐ Hazard ☐ Seismic ☐ Other: _____
Incident History	☐	☑	☐	☐ Breached ☐ Overtop ☐ Slide ☐ Down stream Flooding ☐ Other: _____
Reservoir's Current Use	☐	☑	☐	☐ Sediment ☐ Irrigation ☐ Recreation ☐ Flood Control ☐ Drinking Water ☐ Power Generation ☐ Other: PROBABLE ABANDONMENT

Findings and Corrective Actions:

- ☑ a. The Owner shall maintain documentations including Construction plans, specifications, improvements, modifications, Operations and Maintenance Manuals and routine inspection logs for this dam facility.
- X ☐ b. An Emergency Action Plan (EAP) is on file with the department, submit any updates as applicable. SEE ABOVE
- ☑ c. An EAP is required for High Hazard Dams. Submit an updated EAP for this facility.
- ☐ d. An EAP is recommended for all dams regardless of hazard class. Submit EAP if developed for the facility.
- ☐ e. Submit narrative and additional information detailing the improvements, modifications, and/or alterations at the dam site, unless covered by approved dam permit.
- ☑ f. Routine inspection logs were not inspected.
- ☑ g. Dam owners shall provide for routine inspection of the dam.
- ☑ h. The dam did not appear to be maintained on a regular basis.
- ☐ i. Access to site appears to be satisfactory.
- ☐ j. There is no vehicular access to the dam site. Operational and emergency plans need to reflect this deficiency or access provided.
- ☐ k. Access to dam is questionable during severe weather conditions and/or spillway overflows. Operational plans and emergency plans need to reflect this deficiency or access provided.
- ☐ l. Provide a detailed narrative of the incident, responses taken, and any damages incurred. Dam owners are required to promptly advise the department of any sudden or unprecedented flood or unusual or alarming circumstance or occurrences which may adversely affect the dam or reservoir.
- ☐ m. Submit current Operations and Maintenance Manual or Procedures for this dam / reservoir facility.
- ☐ n. Submit Site or Facility Map of this Dam which identifies the location of major features including outlet works controls and conduits.
- ☐ o. _____

Additional Requirements:

The following investigative study(s) are:

Required	Recommended	
☐	☐	Phase I Study
☐	☐	Phase II Study (Including ☐ Seepage ☐ Hydrology/Hydraulics ☐ EAP)
☐	☐	Hydrology and Hydraulics (including Probable Maximum Flood and spillway capacity)
☐	☐	Stability Analysis
☐	☐	Seismic Analysis
☐	☐	Hazard Classification
☐	☐	Other: _____

Dam ID: HA-0026
LALAKEA RESERVOIR

Inspection No: _____
Date: 04/07/06

Physical Dam Features: (Check All Applicable. Provide description of Items Observed and/or Take Photos. Indicate photo # in description.)

3. Reservoir:

Level during inspection 2' Below GAGE ft per _____ (gage / other)

Normal Operating Level/Range Same ft per _____ (gage / other)

Description: _____

Typical Operation ☐ Spillway always flowing ☐ Kept within normal range ☑ Kept Empty ☐ Drained Daily ☐ Only filled by Storms

☐ Other: _____

Sinkhole in Res.: ☐ # Observed: _____ Size: _____ by _____ in. Deep ☐ Not Visible ☑ None Observed

Description: _____

Staff Gage: Description: POST ON INLET, TRASH RACK

Findings:

☐ a. The reservoir was not inspected.
☑ b. The reservoir appeared to be in satisfactory condition, no corrective actions are required at this time.
☐ c. The reservoir appeared to be in fair to poor condition and requires corrective action.
☐ d. The reservoir appeared to be in unsatisfactory condition, urgent corrective action is required.

Corrective Actions:

☐ e. The staff gage needs maintenance and/or repair. Description: _____
☐ f. A staff gage was not observed at the reservoir. Provide some method of quantifying the water level within the reservoir.
☐ g. A sinkhole was observed in the upstream reservoir. Conduct additional investigations and monitoring to identify the cause, risk and appropriate action.
☐ h. _____

4. Intake Works Description:

☐ Number of Intakes 1
☐ Intake Culvert / Pipe
Size: _____ in. ☐ DIP ☐ Corrugated Metal ☐ PVC ☐ HDPE ☐ Concrete ☐ Other _____
Control: ☐ Gate ☐ Valve ☐ Flow can either be Shut off or Bypassed
From: ☐ Stream Diversion ☐ Pump ☐ Reservoir ☐ Other _____

☑ Ditch / Flume
Dimension: 3'x3' (Size x Depth) Shape RECTANGULAR
Surface: ☐ Dirt ☐ Wood ☑ Concrete ☐ Lined w/ _____
Control: ☐ Gate ☐ Valve ☐ Flow can either be Shut off or Bypassed
From: ☐ Stream Diversion ☐ Pump ☐ Reservoir ☐ Other _____

Findings:

☐ a. The intake works were not inspected.
☐ b. The intake works were not tested.
☑ c. The intake works appeared to be in satisfactory condition, no corrective actions are required at this time.
☐ d. The intake works appeared to be in fair to poor condition and requires corrective action.
☐ e. The intake works appeared to be in unsatisfactory condition, urgent corrective action is required.

Corrective Actions:

☐ f. The intake works needs maintenance and/or repair. Description: _____
☐ g. _____

Dam ID: HA-0026
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Inspection No: _____
Date: 04/07/06

5. Upstream Slope: **(Typical Slope ±** 2H : 1V **)**

Slope Protection: ☑ None ☐ Dumped Rock ☐ Fitted Rip Rap ☐ Grouted Rip Rap ☐ Liner _____ ☐ Other: _____
☐ Defect in Protection: Description: _____

Erosion: ☐ Loose soil w/ little vegetation ☐ Rut (<6") ☐ Gully (>6" deep) ☐ Not Visible ☑ None Observed
Description: _____

Cracks: ☐ Parallel with crest ☐ Perpendicular to crest ☐ Slide visible ☐ Not Visible ☑ None Observed
Description: _____

Sinkholes: ☐ # Observed: _____ Size: _____ and _____ Depth ☐ Not Visible ☑ None Observed
Description: _____

Vegetation: ☑ None ☐ Low Ground Cover ☐ Bushes or Tall Grass ☐ Trees #_____ ☐ <6" ☐ >6" & <20" ☐ >20"
Description: _____

Findings:

☐ a. The upstream slope was not inspected.
☑ b. The upstream slope appeared to be in satisfactory condition, no corrective actions are required at this time.
☐ c. The upstream slope appeared to be in fair to poor condition and requires corrective action.
☐ d. The upstream slope appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

☐ e. Slope protection needs maintenance or repair. Description: _____
☐ f. Rut and/or Gully erosion was observed on the slope, which requires maintenance and/or repair. Description: _____
☐ g. A crack was observed on the slope, which requires further investigation to determine the underlining cause. Monitor the area and/or repair as required.
☐ h. A sinkhole was observed on the slope, which requires further investigation to determine the underlining cause. Repair and monitor the area.
☐ i. The upstream slope was not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.
☐ j. Tree(s) were observed on the dam embankment. Trees have been identified as the probably cause of piping failures, and can possibly cause sever damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.
☐ k. _____

Dam ID: HA-0026
LALAKEA RESERVOIR

Inspection No: _____
Date: 04/07/06

6. Crest: Approximate Crest Width: 20'

Access: ☐ None ☐ Walking Path ☑ Roadway, Surface / Width / Usage: Accessible only 2/3 Lawn

Erosion: ☐ Loose soil w/ little vegetation ☐ Rut (<6") ☐ Gully (>6" deep) ☐ Not Visible ☑ None Observed

Description: _____

Cracks: ☐ Parallel with crest ☐ Perpendicular to crest ☐ Slide visible ☐ Not Visible ☐ None Observed

Description: _____

Sinkholes: ☐ _____ in. Wide x _____ in. Long x _____ in. Deep ☐ Not Visible ☐ None Observed

Description: _____

Vegetation: ☐ None ☐ Low Ground Cover ☒ Bushes or Tall Grass ☐ Trees #_____ ☐ <6" ☑ >6" & <20" ☐ >20"

Description: Ginger + Guinea Grass, Ironwood Trees along U.S. edge

Findings:

- ☐ a. The dam crest was not inspected.
- ☐ b. The dam crest appeared to be in satisfactory condition, no corrective actions are required at this time.
- ☑ c. The dam crest appeared to be in fair to poor condition and requires corrective action. CLEAR BRUSH
- ☐ d. The dam crest appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

- ☐ e. Access along the crest was satisfactory.
- ☑ f. Access along the crest was not possible. Description: BRUSH BLOCKED ACCESS FOR 1/3
- ☐ g. Rut and/or Gully erosion was observed on the crest, which requires maintenance and/or repair. Description: _____
- ☐ h. A crack was observed on the crest, which requires further investigation to determine the underlining cause. Monitor the area and/or repair as required.
- ☐ i. A sinkhole was observed on the crest, which requires further investigation to determine the underlining cause. Repair and monitor the area.
- ☐ j. Portions of the crest were not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.
- ☑ k. Tree(s) were observed along the dam crest. Trees have been identified as the probably cause of piping failures, and can possibly cause sever damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.
- ☐ l. _____

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7. Downstream Slope:

(Typical Slope ± 1½H : 1V)

Access: ☐ lower roadway along toe ☐ roadway to outlet works ☐ walkway to outlet works ☑ None Observed

Slope Protection: ☐ None ☐ Dumped Rock ☐ Rip Rap ☐ Grouted Rip Rap ☐ Concrete

Erosion: ☐ Loose soil w/ little vegetation ☐ Rut (<6") ☐ Gully (>6" deep) ☐ Not Visible ☑ None Observed

Description: _____

Cracks: ☐ Parallel with crest ☐ Perpendicular to crest ☐ Slide visible ☐ Not Visible ☑ None Observed

Description: _____

Sinkholes: ☐ _____ in. Wide x _____ in. Long x _____ in. Deep ☐ Not Visible ☑ None Observed

Description: _____

Vegetation: ☐ None ☐ Low Ground Cover ☐ Bushes or Tall Grass ☐ Trees #_____ ☐ <6" ☐ >6" & <20" ☑ >20"

Description: IRONWOOD, EUCALYPTUS (5' DIA)

Seepage:

Seep Spot Number 1

☐ Green Vegetation ☐ Wet or Muddy Ground ☐ Ponding Water ☐ Not Visible ☑ None Observed

☐ Flowing, Description: _____

Water Clarity: ☐ Clear ☐ Some particles ☐ Muddy ☐ Other: _____

Description: _____

Seep Spot Number 2

☐ Green Vegetation ☐ Wet or Muddy Ground ☐ Ponding Water ☐ Not Visible ☐ None Observed

☐ Flowing, Description: _____

Water Clarity: ☐ Clear ☐ Some particles ☐ Muddy ☐ Other: _____

Description: _____

Findings:

☑ a. The downstream slope was not inspected.

☐ b. The downstream slope appeared to be in satisfactory condition, no corrective actions are required at this time.

☐ c. The downstream slope appeared to be in fair to poor condition and requires corrective action.

☑ d. The downstream slope appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required. TREE REMOVAL REQUIRED

Corrective Actions:

☐ e. Slope protection needs maintenance or repair. Description: _____

☐ f. Rut and/or Gully erosion was observed on the slope, which requires maintenance and/or repair. Description: _____

☐ g. A crack was observed on the slope, which requires further investigation to determine the underlining cause. Monitor the area and/or repair as required.

☐ h. A sinkhole was observed on the slope, which requires further investigation to determine the underlining cause. Repair and monitor the area.

☐ i. The down stream slope was not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.

☑ g. Tree(s) were observed on the downstream slope. Trees have been identified as the probably cause of piping failures, and can possibly cause sever damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.

☐ h. Seepage/Ponding water was observed. Monitor and conduct further investigation to locate the source of water and extent of any possible hazardous or developing condition.

☐ i. Seepage was observed flowing and particles were observed to be removed by the flow. Take immediate action to stop the loss of soil from the embankment. Conduct further investigation to determine the underlining cause and take corrective action. Monitor the area.

☐ j. The slope was very steep, around a 1 to 1 slope, further study is required to verify slope stability.

☑ k. SLOPE IS INACCESSIBLE AND OBSCURED BY VEGETATION

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8. Abutments/Toe:

Erosion: ☐ Loose soil w/ little vegetation ☐ Rut (<6") ☐ Gully (>6" deep) ☐ Not Visible ☑ None Observed

Description: _____

Cracks: ☐ Parallel with crest ☐ Perpendicular to crest ☐ Slide visible ☐ Not Visible ☑ None Observed

Description: _____

Vegetation: ☐ None ☐ Low Ground Cover ☐ Bushes or Tall Grass ☐ Trees #_____ ☐ <6" ☐ >6" & <20" ☑ >20"

Description: Same as D.S. Slope

Seepage:

Seep Spot Number 1

☐ Green Vegetation ☐ Wet or Muddy Ground ☐ Ponding Water ☐ Not Visible ☑ None Observed

☐ Flowing, Description: _____

Water Clarity: ☐ Clear ☐ Some particles ☐ Muddy ☐ Other: _____

Description: _____

Seep Spot Number 2

☐ Green Vegetation ☐ Wet or Muddy Ground ☐ Ponding Water ☐ Not Visible ☑ None Observed

☐ Flowing, Description: _____

Water Clarity: ☐ Clear ☐ Some particles ☐ Muddy ☐ Other: _____

Description: _____

Findings:

☐ a. The abutments/toe were not inspected.

☐ b. The abutments/toe appeared to be in satisfactory condition, no corrective actions are required at this time.

☑ c. The abutments/toe appeared to be in fair to poor condition and requires corrective action.

☐ d. The abutments/toe appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

☐ e. Slope protection needs maintenance or repair. Description: _____

☐ f. Rut and/or Gully erosion was observed, which requires maintenance and/or repair. Description: _____

☐ g. A crack was observed along the abutments/near the toe, which requires further investigation to determine the underlining cause. Monitor the area and/or repair as required.

☐ h. The abutment/toe area was not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.

☑ i. Tree(s) were observed along the abutment/toe. Trees have been identified as the probably cause of piping failures, and can possibly cause sever damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.

☐ j. Seepage/Ponding water was observed. Monitor and conduct further investigation to locate the source of water and extent of any possible hazardous or developing condition.

☐ k. Seepage was observed flowing and particles were observed to be removed by the flow. Take immediate action to stop the loss of soil from the embankment. Conduct further investigation to determine the underlining cause and take corrective action. Monitor the area.

☐ l. _____

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9. Outlet Works:

Culvert / Pipe

Type / Size: 10" DIA.

Culvert: ☐ Concrete ☐ Masonry ☐ unlined earth ☐ Other _____

Pipe: ☑ DIP ☐ Corrugated Metal ☐ PVC ☐ HDPE ☐ Concrete ☐ Other _____

Control Type: ☐ Gate ☑ Valve ☐ Other SCREW GATE

Location: ☐ Control on Upstream side ☑ Control on Downstream side

Seepage: ☐ Green Vegetation ☐ Wet or Muddy Ground ☐ Ponding Water ☐ Not Visible ☑ None Observed

☐ Flowing, Description: _____

Water Clarity: ☐ Clear ☐ Some particles ☐ Muddy ☐ Other: _____

Description: _____

Findings:

☐ a. The outlet works were not inspected.

☑ b. The outlet works were not tested.

☑ c. The outlet works appeared to be in satisfactory condition, no corrective actions are required at this time.

☐ d. The outlet works appeared to be in fair to poor condition and requires corrective action.

☐ e. The outlet works appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

☐ f. Seepage/Ponding water was observed. Conduct further investigation to locate the source of water and extent of any possible hazardous or developing condition.

☐ g. Seepage was observed flowing and particles were observed to be removed by the flow. Take immediate action to stop the loss of soil. Conduct further investigation to determine the underlining cause and take corrective action. Monitor the area. Failures caused by seepage/piping along the outlet conduit are very common and are considered to be a dangerous situation.

☐ h. Were not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.

☐ i. _____

☐ j. _____

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10. Spillway:

Type: ☐ None ☐ Culvert/Pipe ☑ Channel
Description: _____

Dimension: 4' DEEP, 12'-15' AWAY ft. Invert elevation: _____ ft. per staff gage

Slope Protection: ☐ None ☐ Grass ☑ Dumped Rock ☐ Fitted Rip Rap ☐ Grouted Rip Rap ☐ Concrete
☐ Defect in Protection: Description: SMALL ROCKS

Approach: ☑ Clear ☐ High Veg. ☐ Trees ☐ Other: _____

Erosion: ☑ Scour ☐ Gully ☐ Headcut ☐ Not Observed ☐ Other: _____
Description: 3' DEEP HOLE, DENSELY VEGETATED

Vegetation: ☐ None ☐ Low Ground Cover ☑ Bushes or Tall Grass ☐ Trees #_____ ☑ <6" ☐ >6" & <20" ☐ >20"
Description: _____

Findings:

☐ a. The Spillway appeared to be in satisfactory condition, no corrective actions are required at this time.
☐ b. The Spillway appeared to be in fair to poor condition and requires corrective action.
☑ c. The Spillway appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

☐ d. Slope protection needs maintenance or repair. Description: _____
☐ e. The spillway approach was blocked. Clear approach.
☐ f. Severe scour erosion was observed which requires maintenance and/or repair.
Description: _____
☐ g. A headcut (vertical drop in channel due to erosion) was observed downstream of the spillway. Corrective action is required to prevent this problem from moving upstream.
☑ h. Trees are unacceptable in the spillway channel and approach. Take corrective action to address the woody vegetation problem and repair the damaged area.
☑ i. Unclear if spillway is adequately sized. Spillway should pass the probable maximum flood. Verify spillway capacity and take corrective action as required.
☐ j. _____

11. Down Stream Channel:

Name: NOT INSPECTED

Downstream: ☐ Sump ☐ Open Area ☐ Un-Defined Drainage-way ☐ Defined Drainage-way ☐ Other _____

Items along Stream Bank: ☐ None ☐ Road ☐ Houses ☐ Town ☐ Not Inspected

Description: _____

Findings:

☑ a. The downstream channel was not inspected.
☐ b. The downstream channel appeared to be in satisfactory condition, no corrective actions are required at this time.
☐ c. The downstream channel appeared to be in fair to poor condition and requires corrective action.
☐ d. The downstream channel appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

☐ e. _____

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Additional Comments:

On the date of this limited visual inspection, there appeared to be no immediate threat to the safety of the dam. No assurance can be made regarding the dam's condition after this date. Subsequent adverse weather and other factors may affect the dam's condition.

CORRECTION ACTIONS FOR EMBANKMENT MAY BE SO EXTENSIVE AS TO SUPPORT ABANDONMENT AS BEST OPTION. RESERVOIR SERVES NO ECONOMIC OR FLOOD CONTROL PURPOSE. IF FILLED BY STORM, SPILLWAY MAY PERFORM INADEQUATELY, RESULTING IN POSSIBLE OVERTOPPING OF EMBANKMENT. HEAVY VEGETATION AS CURRENTLY ESTABLISHED WOULD AFFORD EROSION PROTECTION FOR FIRST FLOOD, AT LEAST.

Limitations and Intent of this Dam Safety Inspection:

This Dam Safety Inspection was conducted to assess the general overall condition of the reservoir/dam, identify visible deficiencies, and recommend areas of for monitoring, additional investigative studies and corrective actions. The inspection is based only on visible features/areas of the dam on the day of inspection. This inspection is not a formal phase I or phase II dam safety inspection and does not include a review or evaluation from each specialist of an inspection team, such as a geologists, civil, geotechnical, structural, or hydraulics engineer. The owner should verify the findings of this report and take corrective actions. The owner may submit to the State alternative corrective actions that are certified by a licensed professional engineer in the State of Hawaii experienced in the design and construction of dams. This inspection does not relieve the owner/operator from their responsibility to conduct routine inspections, maintenance, repairs, modifications, monitoring, documentation, and/or investigative studies. The inspection was conducted under the authority of the Hawaii Revised Statures Chapter 179D, and Hawaii Administrative Rules, Title 13, Chapter 190, titled "Dams and Reservoirs". Questions regarding this inspection should be forwarded to the Hawaii State Dam Safety Program; PO Box 373; Honolulu, Hawaii 96809; Ph. (808) 587-0236.

Revised: Dec. 1, 2003